

## Workshop Summary

### Evaluating Resources Management Strategies for CWP (Juricich)

An overview was provided of the events from Update 2005 and 2009 of the California Water Plan that led to the analytical framework being presented today. This included a summary of the Water Plan planning process, the vision and goals for the Water Plan quantitative deliverables and the complex questions that stakeholders have asked the Water Plan to answer. Examples of these questions include: *How does water scarcity affect the economy and all beneficial uses? How does water quality affect water management and vice versa?*, and *How does land use affect water management?* The role of SWAN and the public process used by the Water Plan was also described.

### Decision Framework for the CWP (Groves)

A summary was provided of the analytical and decision support framework proposed for Update 2013 of the Water Plan, how it will be applied to describe future water management conditions, and how water managers might respond to those conditions. This included a description of how the Water Plan used growth and climate scenarios in Update 2009 to estimate ranges of future regional water demand changes and how robust decision making techniques will be used to evaluate the performance of alternative water management response packages for Update 2013.

#### Questions:

- In Southern California, are you looking at variation associated with Colorado River supply and Sierra Nevada flows?
  - Answer: The existing model does not include Southern California. The model does show how climate variation may affect the Sierra Nevada runoff.
- Clarification of different models – We are interested in more than the number of scenarios, but looking at scenarios that are important. How likely is it that the scenario will develop? What needs to be monitored to see if scenario is unfolding as expected?
- Uncertainty – is that defined as probability?
  - Answer: It would be hard to apply a probability for any scenario. Instead we are testing strategies across a range of scenarios to see which responds best across a range of conditions. Including many alternative scenarios, reduces the need to assure that any given scenario is correct.
- Are you conducting sensitivity analyses?
  - Answer: Scenario analysis has similarities to sensitivity analysis, but with scenarios different factors are grouped together in themes that tell a story about the future.

### A Collaborative Framework (Cardwell)

A description was provided of how stakeholder involvement and collaboration can be integrated with the technical analysis to support decision making. The technique of Shared Vision Planning promoted by the U.S. Army Corps of Engineers was described, and how it can be used to support the Water Plan. It was described how the activities of the workshop and the role of SWAN are an important part of the Water Plan Collaboration.

A Preliminary Application of the Framework (Joyce and Groves)

An overview was provided of the Water Evaluation And Planning model (WEAP), which is the analytical tool being used to quantify future water management conditions for the California Water Plan. The overview included a description of how WEAP characterizes the hydrologic cycle, water uses, and the water management system. Information was also provided on the specific application of WEAP for the Water Plan.

Key points:

- Characteristics of natural and managed systems – water resource focus
- Climate driven v. operation driven (indoor use)
- Indoor GCPD values are incorporated into scenarios on a very coarse scale
- Uses an average groundwater level – shows bi-directional exchange between groundwater and stream (gaining/losing attributes)
- Scenarios capture water transfers and conjunctive use

Questions:

- Does Land use change over time?
  - Answer: Yes.
- Are instream flow requirements the legal requirements?
  - Answer: Yes.
- What is the time step?
  - Answer: Monthly.
- Do you capture irrigation demand for rice decomposition?
  - Answer: This is not captured in the current model.
- Describe irrigation for crops v. environmental uses
  - Captured under managed wetlands
  - Regulatory in-stream flows are not the same as actual flows in the river
  - Rice decomposition involves a large amount of water
  - You might not want to reduce or redirect water just because agriculture doesn't need it
- Wetlands and rice: target depth and duration for flooding
- Is 20X2020 water conservation included?
  - Answer: Yes on a coarse level.
- Provide a map of the model area in the handouts.
- How is reuse of tailwater in agriculture considered?
  - Answer: Within a region, is considered as one-time consumptive use; tailwater shows up as outflow.
- How much calibration is occurring regarding water transfers and conjunctive use?

Answer: We have not explored detailed connections between these, but this may occur as part of Update 2013 resources management strategies.
- Do you use downscaled climate data?
  - Answer: Yes.

- Is demand adjusted for climate? Can you see sensitivity to climate? Answer: Model was calibrated using past crop land use and demand. The scenarios include future climate projections of temperature and precipitation.
- How does population growth affect the agricultural land use? Urbanization of agricultural land is included within the scenarios.

#### Proof of Concept (Groves)

An overview was provided of the Proof of Concept for applying Robust Decision Making to Update 2013. This included a summary of the proposed Water Plan scenarios, the individual resource management strategies that were selected for the proof of concept, and how strategies were grouped into response packages for the analysis, and what metrics were developed to evaluate strategy response.

#### Questions:

- How are Delta exports calculated?
- Why are exports called out as a metric?
- Clarify what dots in the results represent (e.g. is big dot bad?)
- Are thresholds global or can they be region-specific?

#### Comments:

- Efficiencies often mean loss of flexibility for user
- EID has a drought contingency model – you might want to consider it for the future
- Look at building economics into WEAP
- Post-processing: Create an extra output about how choices affect the range of choices in the future
- For ag stewardship and watershed management, include both capital and operating costs into annualized values.
- Describe how much investment in strategies is needed.
- Consider economic impacts to 3<sup>rd</sup> parties – e.g. long-term drought
- Clarify what assumptions are in the baseline and what can be a strategy (uncertainties v. policies)

#### Breakout Sessions

##### **Breakout Session A: Model Outputs and Analysis Metrics**

This session allowed participants to interactively explore the key CWP WEAP Model outputs, discuss the metrics used to summarize this outputs for a Proof-of-Concept RDM analysis, and experiment with how metrics are specified. The break-out session on metrics discussed a broad range of issues. Participants suggested focusing on a broader array of environmental outcomes, such as water quality, water temperature. There was also a suggestion to consider the number of consecutive years an in-stream flow requirement was not met during the months most relevant for the requirement, as an indicator of the health of fish population which the flow requirements are meant to protect. Suggestions also focused on the geographic distribution of results, to ensure the ability to focus in on one's individual region. Tied into this, allowing

localities to implement different response package was recommended. Participants also considered the possibility of rather than having a cost-effectiveness analysis, converting the outcomes of the model into some dollar value (particularly with unmet agricultural water demand) facilitating a cost benefit analysis. Topics outside the realm of metrics were also discussed, particularly the treatment of groundwater. Participants recommended a broader range of restrictions on groundwater or treating utilizing groundwater as a management strategy, which could be further drawn down based on previous years' climate conditions.

### **Breakout Session B: Water Management Response Packages**

In this breakout group, it was demonstrated how the CWP WEAP model has been programmed to simulate four different management strategies in the Central Valley. It was discussed how these strategies were grouped together to comprise many Response Packages for a Proof-of-Concept RDM analysis. Finally, participants interactively explored how the different response packages affect key water management outcomes for different scenarios.

#### Questions/comments:

- Describe how WEAP captures agricultural and urban water use efficiency.
- Do you capture land fallowing?
  - Answer: Not at this time, but it is possible with the tool.
- Do you capture tail water re-use?
  - Answer: Not at this time, but it is possible with the tool.
- You should consider the linkage between recycled water, water use efficiency and water needed for environmental mitigation or enhancement.
- Does the conjunctive water management strategy capture in-lieu recharge?
- Does the analysis capture reduced groundwater recharge resulting from increased agricultural water use efficiency?
  - Answer: The model can capture the relationship between on farm water use efficiency and groundwater recharge on a coarse scale.
- Does the model include linkage between soil type and groundwater recharge?
  - Answer: Yes.
- The strategies should describe the linkage between land use and water use.
- As presented you are bundling individual resource management strategies into management response packages. You should unbundle the response package.
- Include agricultural land stewardship as a water management strategy.
- Provide information on the data sources you used to come up with the strategies.
- Use the Inland Empire Utilities Agency approach presented in a past workshop.
- Please clarify the key terms: Scenarios vs strategies vs response packages.
- Document the source of the data on the strategies.
- You should capture the effects of Sacramento River water use efficiency on export areas.
- Do you capture Yolo County water management features?
- Do you capture crop specific efficiency trends?

- Answer: No.
- Do you capture State Water Project allocations?
  - Answer: No, the model does not represent SWP or CVP specific allocation decisions.
- How will resource strategies be represented in the hydrologic regions outside the Central Valley?
  - Answer: The hydrologic regions outside the Central Valley will only include representation of scenarios of future demand, similar to what was done for Update 2009. Due to the coarse representation of the hydrologic regions outside the Central Valley, resource management strategies will not be evaluated dynamically to evaluate performance and robustness. However, the Water Plan Regional Reports will include a discussion future implementation of resource strategies identified in existing planning documents.
- How is outdoor urban water use efficiency represented?
  - Answer: WEAP uses outside landscape area to estimate the effects of future climate and water use efficiency on outdoor urban water use.
- How does WEAP represent soil type?
- How does WEAP determine ETAW?
- Does WEAP account for land subsidence?
  - Answer: WEAP doesn't represent land subsidence, but it is possible to link WEAP to detailed groundwater models that capture subsidence.

### **Breakout Session C: Evaluating Response Packages Under Uncertainty**

This session built upon the earlier plenary discussion of RDM and the proof-of-concept analysis. Participants interactively worked through the key steps of a Proof-of-Concept RDM analysis, focusing on: (1) the development of performance thresholds, (2) identification of vulnerabilities, and (3) evaluation of key tradeoffs among robust response packages. The Break-out session on Robust Decision Making focused on both the presentation of materials from the Proof-of-Concept, and what issues future analyses should explore. One theme from emerging from this group was the importance of how material is presented to different stakeholders. Materials in the SWAN Workshop largely went through the mechanics of how the Proof-of-Concept was completed, where for other stakeholders, focusing on the results of the analysis, which response packages are effective under which conditions will be more effective. Other suggestions focused on the range of uncertainties considered in the model, including having a broader array of climate inputs, such the Bay-Delta Conservation Plan's Climate Scenarios, and disaggregating different elements of the Land-Use Narratives. There was also a suggestion that as water policies are not often considered in complete bundles, running different management strategies, separately to understand their individual effects would contain valuable information.

#### **Breakout Session Plenary Report Out**

Feedback was provided on the Breakout Sessions today.

- Participants felt the approach was understandable and the workshop format was good.
- Could have used a bigger projector.

- Needed more time in the breakout sessions.
- Too much time spent in breakout session going through different graphics. It distracted the conversation.
- Spent too much time looking at tool than discussing desired outcomes of session.
- Need to have clear breakout session purpose.
- Provide different level of detail between the first and second sessions.
- Make the WEAP and other tools available to the group.
- You had a generally receptive audience with a technical background. You may have problems explaining the scenarios to others.
- You should consider using a hind casting approach to verify the model.
- Has the model gone through a formal peer review process? Answer: There are many peer reviewed professional journal articles on WEAP applications around the world. The WEAP model itself has not gone through a specific peer reviewed testing and validation.
- The accuracy of the groundwater representation within WEAP may become an issue.
- Will the management responses presented in the analysis be different from region to region? Answer: The analytical framework has the ability to define different management response for different regions.
- How will you ground truth the strategy assumptions? Answer: We are relying on existing planning documents to develop assumptions about the level of strategy implementation. We will present these assumptions through SWAN and other Water Plan public outreach meetings.
- Provide access to the model.

#### Moving Forward with the Analytical and Decision Support Framework

Feedback was provided on the overall analytical and decision support framework presented today.

Cautions about the proposed approach:

- Discuss environmental and economic impacts
- Recommend that approach be vetted with regional areas included in the Water Plan.
- Include something on long term/extended droughts
- Include something on flood impacts and tie flood management strategies to water management strategies.
- Need to interact with the regional groups at the basin scale to help with quality assurance and quality control.
- Describe how this analysis will/could interact with other analytical tools like MWD's IRPSIM tool.
- There is a concern that the model will become shelfware. Describe how you will scale down the analysis to the local level and convince others to work with the Water Plan.